MixSim: A Hierarchical Framework for Mixed Reality Traffic Simulation

Simon Suo*, Kelvin Wong*, Justin Xu, James Tu,
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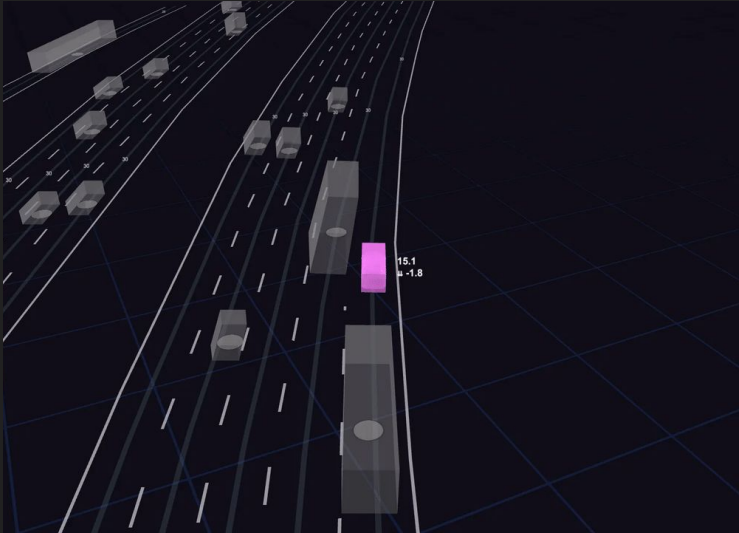
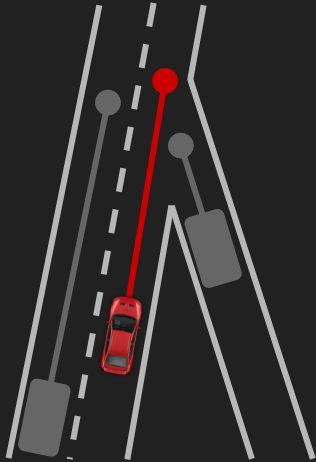UNIVERSITY OF TORONTO

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Contains audio

Industry today: non-reactive open-loop log replay
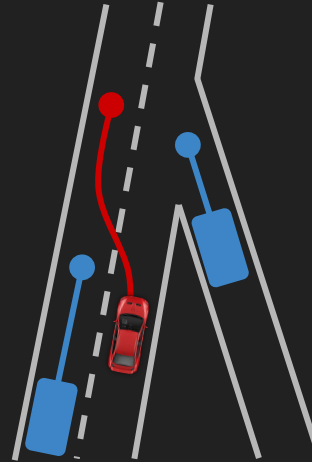

✗ Traffic agents do not react to the SDV

✗ SDV cannot observe consequences of its actions

✗ Cannot evaluate SDV in hypothetical situations
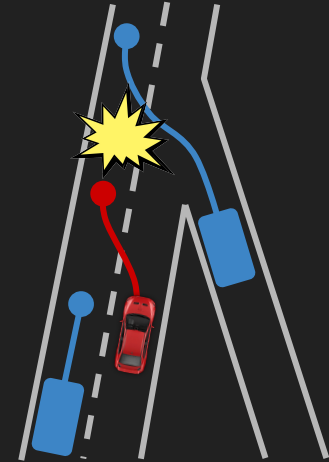
Mixed reality traffic simulation

Real World Scenario

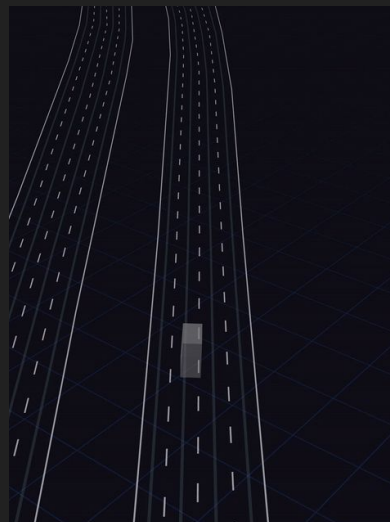**Reactive** and **Controllable** Digital Twin
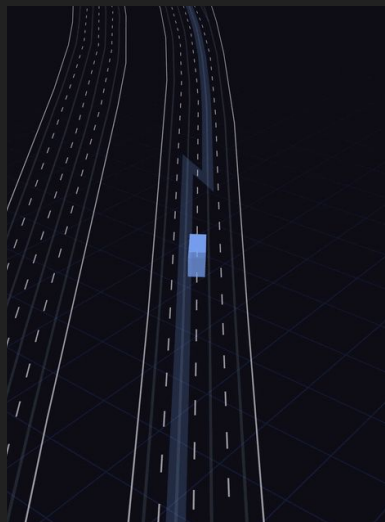
What if **SDV** lane changes?

What if **agent** cuts in front?
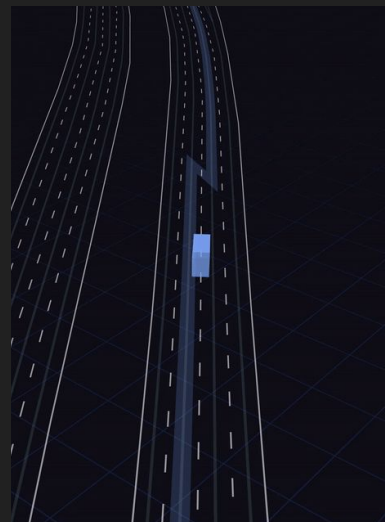
MixSim: our hierarchical framework

Initial Scenario Context
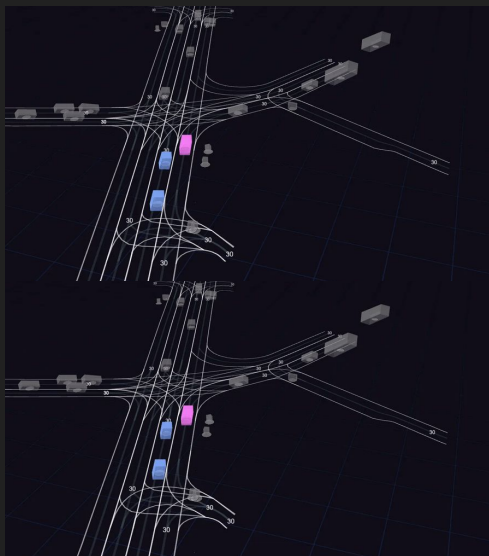
Routing

Route

Route-conditional policy

Reactive Simulation

MixSim: simulating mixed reality traffic scenarios

What if the **SDV** brakes?

What if the **agents** take different routes?

What if an **agent** cuts in front of the **SDV**?

Reactive re-simulation

What if the **SDV** brakes?

What if the **agents** take different routes?

What if an **agent** cuts in front of the **SDV**?

Reactive re-simulation

Sampling realistic variations

What if the **SDV** brakes?

What if the **agents** take different routes?

What if an **agent** cuts in front of the **SDV**?

Sampling realistic variations

MixSim: simulating mixed reality traffic scenarios

What if the **SDV** brakes?

What if the **agents** take different routes?

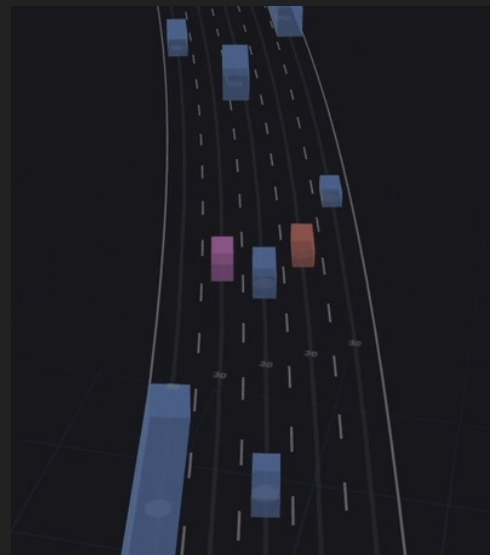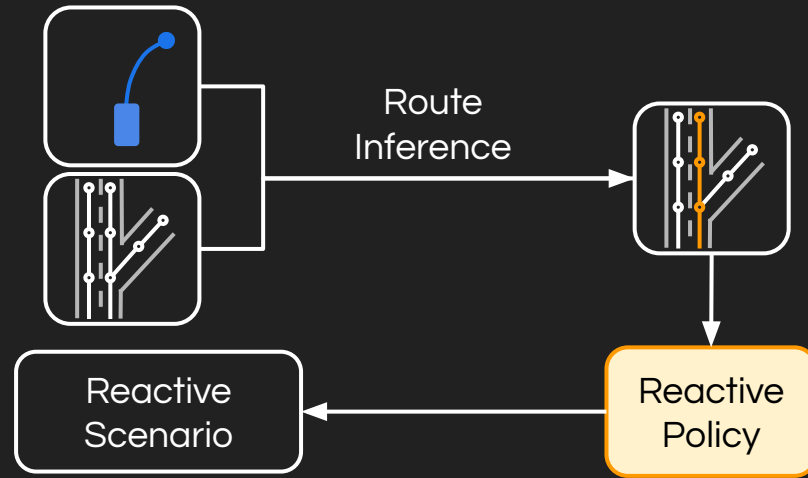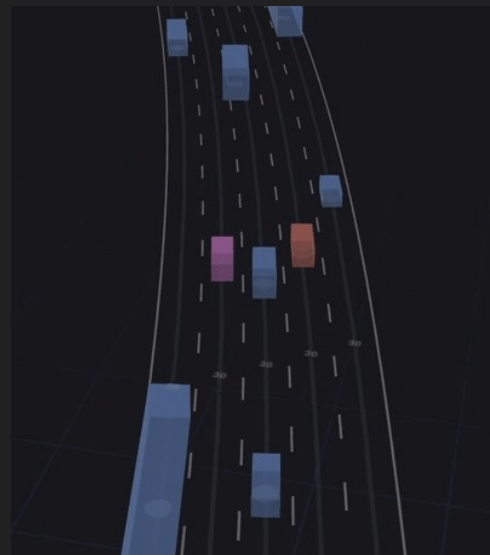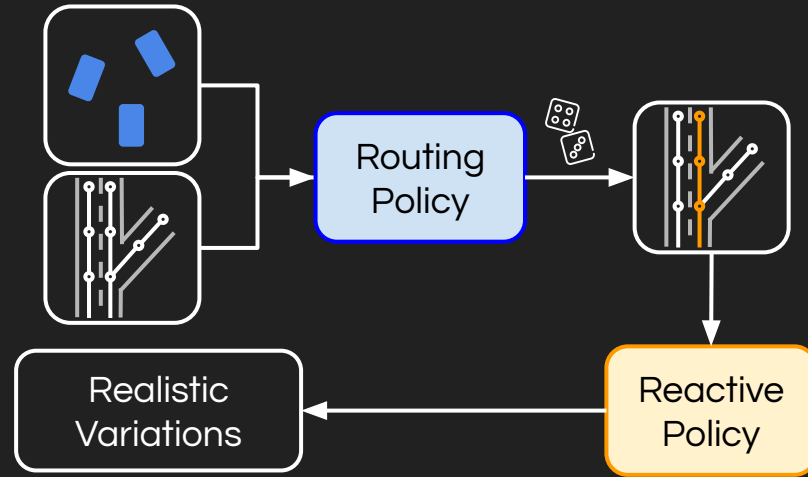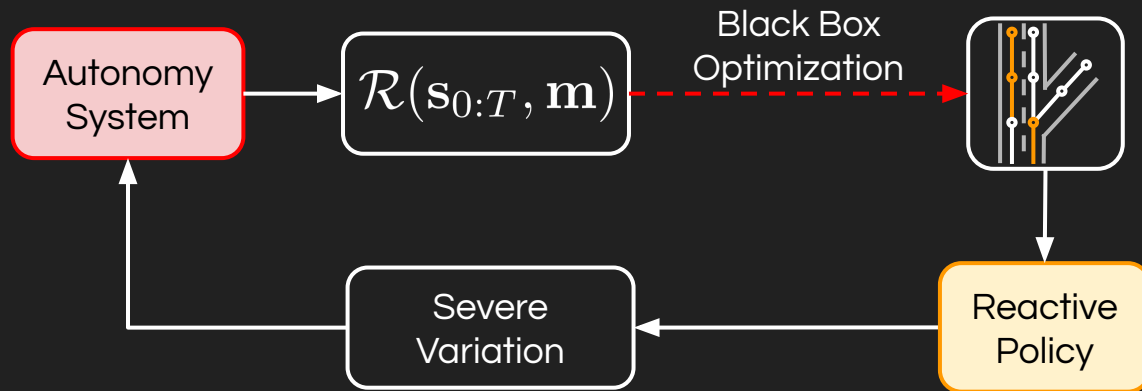What if an **agent** cuts in front of the **SDV**?

Finding safety-critical variations

Summary

- MixSim: a hierarchical framework for *mixed reality traffic simulation*
    - Learn a hierarchical policy disentangling route from controls
    - By varying routes, we can simulate mixed reality traffic scenarios
- MixSim can re-simulate a real world scenario and explore its *what-if* scenarios
- This enables us to safely and accurately test an SDV in closed-loop simulation

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